Title: An exploratory study of auditory verbal hallucinations and other psychotic symptoms in youth with borderline personality disorder compared with youth with schizophrenia spectrum disorder

Running head: AVH in youth with BPD

Authors: Marialuisa Cavelti[1,2,4,5], Katherine Thompson[1,2,] Carol Hulbert[4], Jennifer Betts[1,2], Henry Jackson[4], Shona Francey[1,2], Philipp Homan[5,6], Andrew Chanen[1,2,3]

Corresponding author: andrew.chanen@orygen.org.au

Affiliations:

1 Orygen, The National Centre of Excellence in Youth Mental Health, Melbourne, Australia

2 Centre for Youth Mental Health, The University of Melbourne, Melbourne, Australia

3 Orygen Youth Health, Melbourne, Australia

4 Melbourne School of Psychological Sciences, The University of Melbourne, Australia

5 Translational Research Centre, University Hospital of Psychiatry and Psychotherapy, University of Bern, Bern, Switzerland

6 Center for Psychiatric Neuroscience, Feinstein Institute for Medical Research, Hofstra Northwell School of Medicine, Manhasset, NY, USA

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Abstract

Objective: This study explored auditory verbal hallucinations (AVH) and other psychotic symptoms in youth with borderline personality disorder (BPD).

Methods: Sixty-eight outpatients, aged 15-25 years, were categorized into three groups according to their primary DSM-5 diagnosis and AVH symptom profile; BPD+AVH (n=23), schizophrenia spectrum disorder (SZ)+AVH (n=22), BPD with no AVH (n=23).

Results: No differences in AVH were found between BPD+AVH and SZ+AVH. Compared with SZ+AVH, BPD+AVH scored lower on delusions and difficulty in abstract thinking, and higher on hostility. BPD+AVH reported more severe self-harm, paranoid ideation, dissociation, anxiety, and stress than BPD no AVH. Conclusions: This study replicates in a sample of youth the finding from studies of adults that AVH in BPD are indistinguishable from those in SZ, when assessed by the Psychotic Symptom Rating Scales (PSYRATS). Clinicians should enquire whether youth with BPD experience AVH and consider them an indicator of a more severe form of BPD.

Keywords: Hearing voices, schizophrenia, psychotic symptoms, adolescence, young adulthood

Auditory verbal hallucinations and other psychotic symptoms in youth with borderline personality disorder

Introduction

Psychotic symptoms that occur in individuals with borderline personality disorder (BPD), have historically been described as "psychotic-like" symptoms or "pseudo-" or "quasi-hallucinations" (Kingdon et al., 2010; Niemantsverdriet et al., 2017; Yee et al., 2005). This has been codified in the American Psychiatric Association's Diagnostic and Statistical Manual (DSM) of Mental Disorders and the International Classification of Diseases (ICD). The DSM suggests that psychotic symptoms are only present in the limited form described in the ninth diagnostic criterion for BPD, "*transient, stress related paranoid ideation or severe dissociative symptoms"* (p. 652) (American Psychiatric Association, 1994).

Recent research in adults with BPD has challenged these assumptions, reporting that multimodal hallucinations, delusions, paranoia and dissociation are common among people with BPD (Kingdon et al., 2010; Niemantsverdriet et al., 2017; Slotema et al., 2012; Tschoeke, Steinert, Flammer, & Uhlmann, 2014). For example, auditory verbal hallucinations (AVH) are reported to occur in 13.7%-50% of adults with BPD (Kelleher & DeVylder, 2017; Merrett, Rossell, & Castle, 2016; Niemantsverdriet et al., 2017). They are reported to be similar to AVH in schizophrenia with regard to most phenomenological characteristics (Merrett et al., 2016), such as frequency, duration, location, loudness, and beliefs about the origin of voices (Kingdon et al., 2010; Pearse, Dibben, Ziauddeen, Denman, & McKenna, 2014; Slotema et al., 2012; Tschoeke et al., 2014). Some differences have also been found. Patients with BPD have reported more negative voice content (Kingdon et al., 2010), feeling more controlled (Tschoeke et al., 2014) and distressed (Kingdon et al., 2010) by their voices, and responding with more "emotional resistance" towards their voices (Hepworth, Ashcroft,

& Kingdon, 2013) than patients with schizophrenia, although they experience their voices as less disruptive (Slotema et al., 2012).

Hallucinations in adults with BPD have been reported to co-occur with delusional thinking, but not with negative or disorganized symptoms (Niemantsverdriet et al., 2017). Compared with adults with schizophrenia and AVH, adults with BPD and AVH have been reported to have less severe delusions, conceptual disorganization, and negative symptoms (Tschoeke et al., 2014). Importantly, the presence and severity of hallucinations in patients with BPD has been correlated with a greater number of co-occurring psychiatric diagnoses, along with a greater number of suicidal plans and attempts, and more hospitalisations (Slotema et al., 2017).

Significant clinical emphasis is often placed upon the role of childhood adversity in the aetiology of AVH in BPD. Yet, studies that have examined the relationship between childhood adversity and AVH in adults with BPD have reported inconsistent findings. One study reported a positive correlation between emotional abuse in childhood and the severity of hallucinations (Niemantsverdriet et al., 2017) but two studies did not find any association between childhood trauma and AVH (Kingdon et al., 2010; Tschoeke et al., 2014). The latter finding stands in contrast to the well-established relationship between childhood adversity and the the severity of hallucinations in people with psychotic disorders (Bailey et al., 2018). Similarly, dissociative experiences have been strongly related to voice-hearing in psychotic disorders, and might be a mediating factor in the relationship between trauma and hallucinations in this group (Pearce et al., 2017; Pilton, Varese, Berry, & Bucci, 2015). However, in a study of 23 adults with BPD, no association was reported between dissociation and psychotic symptoms in general, or between dissociation and hallucinations (Tschoeke et al., 2014).

To date, all studies examining AVH in BPD have focused on adults with established disorder, even though adolescence and young adulthood is the sensitive period for the development, detection, and early treatment of both BPD (Chanen & McCutcheon, 2013; Chanen & Thompson, 2014; Sharp & Wall, 2017) and psychosis (McGorry, Purcell, Goldstone, & Paul Amminger, 2011). It is now well accepted that BPD can be reliably diagnosed before the age of 18 (Chanen & McCutcheon, 2013; Kaess, Brunner, & Chanen, 2014) and that BPD in young people is continuous with BPD in adults (Chanen, 2015). While auditory hallucinations in children and adolescents are common (5%-21%) and mostly transitory (De Loore et al., 2011), they persist in a subgroup of youth, who are at a high risk for poor outcomes, including multimorbid (psychotic and non-psychotic) mental disorders, suicidality, and poor social and occupational functioning (Kelleher, 2016). There is now strong support for early intervention (i.e., treatment of subthreshold disorder or shortly after reaching diagnostic threshold for a disorder) for psychotic disorders (Correll et al., 2018) and emerging support for early intervention for BPD (Chanen, 2015; Chanen & McCutcheon, 2013; Chanen, Sharp, Hoffman, & Global Alliance for Prevention and Early Intervention for Borderline Personality Disorder, 2017). Clearly, more information is required to clarify the co-occurrence of BPD and AVH in youth in order to make progress in early intervention for severe mental disorders.

This study is the first to examine the phenomenology of AVH in a sample of outpatient youth (aged 15-25 years) with BPD, during the period when symptoms of both BPD and psychotic disorders emerge for the first time. The primary goal of the study was to compare AVH and other psychotic symptoms occurring among youth with BPD with those occurring among youth with schizophrenia spectrum disorder (SZ). The secondary goal of the study was to compare youth with BPD who experience AVH with youth with BPD who do not experience AVH. In order to ascertain whether the findings from studies of adults with BPD and AVH

are generalizable to youth with BPD and AVH, we investigated the following research questions:

1. Are AVH in youth with BPD similar to, or different from, those in youth with SZ?
2. Do youth with BPD and AVH differ from youth with SZ and AVH with regard to the severity of other positive or negative psychotic symptoms?
3. Is the presence of hallucinations associated with other positive or negative symptoms in youth with AVH and do these associations differ between youth with BPD and those with SZ?
4. Do youth with BPD and AVH differ from youth with SZ and AVH with regard to severity of dissociative symptoms, is the presence of hallucinations in youth with AVH associated with dissociative symptoms and do these associations differ between youth with BPD and those with SZ?
5. Do youth with BPD who experience AVH differ from youth with BPD who do not experience AVH in terms of psychopathology (e.g., BPD features, co-occurring psychiatric diagnoses) and/or functional impairments?

Methods

Participants

Sixty-eight help-seeking 15-25 year-old outpatients participated in the study. All participants were fluent in English. Participants were categorized into three groups according to their primary diagnosis and AVH symptom profile; *viz.* BPD+AVH (n=23), SZ+AVH (n=22), and BPD with no AVH (BPD no AVH; n=23). AVH were defined as present for more than one week within the past three months according to the threshold set in the Comprehensive Assessment of At Risk Mental State (CAARMS) (Yung, Yuen, Phillips, Francey, & McGorry, 2003); an intensity rating of 5 or higher and a frequency rating of 4 or higher on the Perceptual Abnormalities subscale. This corresponds to hearing voices (i) at least three times a week for more than an hour per occasion; or (ii) daily for any duration per occasion.

The BPD+AVH group included youth with a DSM-5 (American Psychiatric Association, 2013) BPD diagnosis and CAARMS threshold AVH. Participants were excluded from this group if they were diagnosed with a delusional disorder, schizophreniform disorder, schizophrenia, schizoaffective disorder, substance/medication-induced psychotic disorder, psychotic disorder due to another medical condition, catatonia, or bipolar I disorder according to DSM-5.

The SZ+AVH group included youth with a DSM-5 brief psychotic disorder, schizophreniform disorder, schizophrenia, or schizoaffective disorder and CAARMS threshold AVH. Exclusion criteria for this group were a delusional disorder, substance/medication-induced psychotic disorder, psychotic disorder due to another medical condition, catatonia, or bipolar I disorder, or having more than two DSM-5 BPD criteria.

The BPD no AVH comprised youth with a DSM-5 BPD diagnosis and no CAARMS threshold AVH. Exclusion criteria for this group were a DSM-5 schizophrenia spectrum or other psychotic disorder, bipolar I disorder, or mental disorder due to a medical condition.

Procedure

Participants were recruited between June 2016 and February 2018 from Orygen Youth Health, the state government-funded specialist mental health service for 15-25 year-olds living in northwestern and western metropolitan Melbourne, Australia. The service includes specialist early intervention programs for psychosis (McGorry, Edwards, Mihalopoulos, Harrigan, & Jackson, 1996) and for BPD (Chanen et al., 2009). Five-hundred and thirty-nine clients from these programs were screened for the study using routinely collected clinical data. Of 139 clients invited to participate in the study, 87 were consented. Written informed consent was obtained from all participants aged 18 years and over, and additionally from a parent or guardian for those under 18 years. Participants were interviewed by a clinical psychologist-researcher or by graduate research assistants who were specifically trained in the application of the measures and reimbursed for time and expenses. The final sample consisted for 68 participants who completed the assessment and turned out to be eligible. The study was approved by the Melbourne Health Human Research Ethics Committee (MHREC2016.086).

Measures

Participants were assessed using the positive symptom scales of the CAARMS, a semi-structured interview conducted to determine the presence, type, frequency, and severity of subthreshold and threshold psychotic symptoms (Yung et al., 2003). The Perceptual Abnormalities subscale was used to assess AVH, as described above. The modules A-D

(affective and psychotic disorders) of the Structured Clinical Interview for DSM-5, Research Version (SCID-5-RV) (First, Williams, Karg, & Spitzer, 2015) and the BPD section of the Structured Clinical Interview for DSM-5 Personality Disorders (SCID-5-PD) (First, Williams, Benjamin, & Spitzer, 2015) were administered to either establish or rule out the diagnoses of a schizophrenia spectrum disorder or BPD, respectively.

After establishing eligibility for the study, a series of interviews and questionnaires were administered and demographic data were collected. Residential postcode was used to determine socioeconomic status according to the index of relative socio-economic disadvantage (IRSD) (ABS, 2011). The tertiles of the rank (i.e., low, middle, and high socioeconomic status) were used for analyses.

All participants filled in the Dissociation Tension Scale (DSS) (Stiglmayr et al., 2010). The DSS consists of 21 items assessing for dissociative symptoms occurring in the past week. Ratings are made on a time-oriented scale ranging from 0% (never) to 100% (constantly). Internal consistency in the current study was excellent (Cronbach's alpha = 0.95).

The severity of psychotic symptoms in the BPD+AVH and SZ+AVH groups were assessed using the Auditory Hallucinations subscale of the Psychotic Symptom Rating Scales (PSYRATS-AH) (Haddock, McCarron, Tarrier, & Faragher, 1999) and the Positive and Negative Scales of the Positive And Negative Syndrome Scale (PANSS) (Kay, Fiszbein, & Opler, 1987). The PSYRATS-AH measures the following phenomenological characteristics of AVH on a five-point scale (0-4): frequency, duration, location, loudness, beliefs about origin of voices, amount of negative content of voices, degree of negative content, amount of distress, intensity of distress, disruption to life caused by voices, and controllability of voices. The PANSS was used to assess positive and negative symptoms with a rating scale ranging from 1 (absent) to 7 (extreme).

Several indices of severity of psychopathology were assessed in the BPD+AVH group and the BPD no AVH group, including dissociation, co-occurring psychiatric diagnoses, severity of BPD features, depressive, anxiety, and stress symptoms, and psychosocial functioning. Dissociation was measured by the DSS, as reported above. Comorbid mental state and personality disorders were assessed using SCID-5-RV modules E (substance use disorders), F (anxiety disorders), G (obsessive-compulsive and related disorders), I (feeding and eating disorders), K (externalizing disorders), and L (trauma- and stressor-related disorders) of the and the remaining sections of the SCID-5-PD. The number of co-occurring mental state or personality disorders (in addition to BPD) was used for analyses.

The Borderline Personality Disorder Severity Index 4th edition (BPDSI) (Arntz et al., 2003) was administered to capture frequency and severity of BPD features, according to DSM-IV (i.e., abandonment, interpersonal relationships, identity disturbance, impulsivity, parasuicidal behaviour (including both self-harm without suicidal intention and suicidal thoughts, plans, and attempts), affective instability, emptiness, outburst of anger, and dissociation and paranoid ideation) during the previous three months. The measure consists of 70 items that are rated regarding their frequency (never = 0 to daily = 10), except the eight items of the 'identity disturbance' subscale, which aim to assess for a stable sense of self on a 5-point Likert scale (0 = absent to 4 = clear and dominant). Cronbach's alpha of the subscales in the current study ranged between 0.70 and 0.88, indicating adequate to good internal consistency. Four items of the interpersonal relationships subscale ask about intimate/romantic partner. The average score for the interpersonal relationships subscale was calculated based on the number of items that were applicable (i.e., a mean across eight items if the participant had a partner, and a mean across four items if the participant did not). For the analyses, the parasuicidal behaviour subscale was split into two separate subscales, assessing self-harm (8 items; Cronbach's alpha = 0.86) and suicidal thoughts, plans, and attempts (5 items;

Cronbach's alpha = 0.77), respectively. Similarly, the five items of the dissociation and paranoid ideation subscale assessing for dissociation (Cronbach's alpha = 0.79) and the three items assessing for paranoid ideation (Cronbach's alpha = 0.81) were used separately.

The 21-item version of the Depression Anxiety Stress Scales (DASS-21) (Antony, Bieling, Cox, Enns, & Swinson, 1998) was administered to assess for features of depression (depression subscale), hyperarousal (anxiety subscale), and tension (stress subscale) over the previous week. The items are rated on a 4-point Likert scale (0 = did not apply to me at all to 3 = applied to me very much, or most of the time). Internal consistency in the current study was good, with Cronbach's alpha ranging from 0.85 to 0.91.

General psychosocial functioning was assessed using the Social and Occupational Functioning Assessment Scale (SOFAS) (Goldman, Skodol, & Lave, 1992), which ranges from 1 (persistent instability to maintain minimal personal hygiene, unable to function without harming self or others or without considerable external support) to 100 (superior functioning in a wide range of activities).

Statistical analyses

Statistical analyses were performed using IBM SPSS Statistics for Windows, version 22.0 (IBM Corp., Released 2013). Missing value analyses revealed one missing value in the DASS-21 and two missing values in the DSS. These missing values were completely at random, as indicated by non-significant Little's MCAR tests, and replaced by expectation maximization methods (Tabachnick & Fidell, 2007). In addition, one participant had missing values in all the BPDSI items, three participants had missing values in all the PANSS items, and two participants did not fill in the DSS. These participants were excluded from the analyses that involved these particular measures.

Demographic characteristics were compared between the three groups using chi-square tests (education status, employment status), Fisher's exact tests if expected cell counts of categorical variables were less than five (gender, relationship status, financial support, socioeconomic status), and one-way ANOVA with Tukey post hoc tests (age). Multiple z-tests of two proportions were used to follow-up a statistically significant chi square test, and multiple Fisher's exact tests to follow-up a statistically significant Fisher's exact test. In both cases, a Bonferroni correction was applied.

Mann-Whitney *U* tests were used to compare the BPD+AVH and SZ+AVH groups on severity of psychotic symptoms (PSYRATS-AH items, PANSS items) and dissociative symptoms (DSS) (research questions 1, 2, and 4). In order to examine the relationship between hallucinations and other psychotic symptoms (research question 3), Spearman's correlations between the hallucinatory behaviour (P3) item and all other positive and negative symptoms items of the PANSS were calculated. In addition, in order to assess the relationship between dissociation and psychotic symptoms (research question 4), Spearman's correlations between the DSS and the PANSS hallucinatory behaviour item (P3), as well as between the DSS and the PSYRATS-AH items were calculated. First, the correlation analyses were conducted using the data of all hallucinating participants, including the BPD+AVH group and the SZ+AVH group. Next, the correlation analyses were repeated for the BPD+AVH group and the SZ+AVH group separately, and correlation coefficients between the groups were compared using Fisher's *Z* test, adapted for Spearman's rho in accordance with Sheskin (2011). In order to examine research question 5, the BPD+AVH group and the BPD no AVH group were compared with regard to psychopathology and functioning using t-test for independent samples (SOFAS), and Mann-Whitney *U* tests (number of co-occurring mental state diagnoses, number of co-occurring PD diagnoses, BPDSI subscales, DASS-21 depression, anxiety, and stress subscales, DSS).

Non-parametric tests were used if variables had an ordinal scale, were not normally distributed across groups, normality could not be achieved through transformation, and/or outliers were detected by visual inspection of box-plots. To provide an estimate of the size of observed effects that was independent of the sample size and measure used (Maher, Markey, & Ebert-May, 2013), effect sizes (Cohen's *d*, r, and θ) and their confidence intervals (CI) were calculated for group differences and relationships of variables of interest. θ=U/mn is the generalised Mann-Whitney effect size measure that ranges from 0 and 1, taking the value 0.5 on the null hypothesis (identically distributed) and 0 or 1 if there is no overlap between the two samples (Newcombe, 2006a). Newcombe (2006b) provided an excel spreadsheet, which was used to calculate θ and its CI. Theta values between 0.4-0.6 were considered as small, between 0.61-0.8 and 0.2-0.39 as moderate, and between 0.81-1 and 0-1.9 as large. The sizes of *d* and r were interpreted according to Cohen (1988). Multiple comparisons were not corrected for, as this study was exploratory in nature (Feise, 2002; Rothman, 1990).

Results

Participants' characteristics

The demographic characteristics of the 68 participants are presented in Table 1. The BPD no AVH group and the BPD+AVH group included significantly more females than the SZ+AVH group ($p<.05$). Participants in the BPD+AVH group were significantly younger than participants in the BPD no AVH group ($p=.033$) and the SZ+AVH group ($p=.046$). A higher number of participants in the BPD+AVH group were enrolled in education, compared with participants in the SZ+AVH group ($p<.05$).

The participants in the SZ+AVH group were diagnosed with the following psychotic disorders: 1 (4.5%) with brief psychotic disorder, 6 (27.3%) with schizophreniform disorder, 3 (13.6%) with schizoaffective disorder, and 12 (54.5%) with schizophrenia.

AVH in youth with BPD compared to youth with SZ (research question 1)

The results of the comparison of the phenomenological characteristics of AVH as assessed by the PSYRATS-AH between the BPD+AVH group and the SZ+AVH group are presented in Table 2. No significant differences in the PSYRATS-AH items were found between participants with BPD and those with SZ, except that the degree of negative voice content was higher in the BPD group ($\theta=0.34$, 95% CI [0.21, 0.51]). However, the CI for the effect sizes of all comparisons (including for the degree of negative voice content) included 0.5, indicating that the distributions of the items between the groups were identical. These results indicate that AVH in youth with BPD were phenomenologically indistinguishable from those in youth with SZ.

Positive and negative symptoms in youth with BPD+AVH compared to youth with SZ+AVH (research question 2)

Table 3 shows the comparison of negative and positive symptoms as assessed by the PANSS between the BPD+AVH group and the SZ+AVH group. Participants with BPD had significantly lower scores on delusions and difficulty in abstract thinking, and higher scores on hostility than participants with SZ. As shown in Table 3, the effect sizes for these group differences were moderate.

Associations of hallucinations with other positive and negative symptoms in youth with BPD compared to youth with SZ (research question 3)

In the group including both BPD+AVH and SZ+AVH participants, the hallucinatory behaviour (P3) item was not significantly correlated with other positive and negative symptom items of the PANSS (p>.05), except for a strong correlation with more severe delusions; r_s=.50, p=.001, 95% CI [0.23, 0.70]. When the correlation analyses were repeated in the two groups separately and compared between the groups, significant group differences were found in the correlations between hallucinatory behaviour and delusions (p=.021), conceptual disorganization (p=.036), passive/apathetic social withdrawal (p=.016), lack of spontaneity and flow of conversation (p=.014), and stereotyped thinking (p=.023). In the SZ+AVH group, hallucinatory behaviour was moderately to strongly correlated with more severe delusions (r_s=.74, p<.000, 95% CI [0.46, 0.89]), conceptual disorganization (r_s=.49, p=.021, 95% CI [0.09, 0.76]), passive/apathetic social withdrawal (r_s=.55, p=.008, 95% CI [0.17, 0.79]), and stereotyped thinking (r_s=.53, p=.011, 95% CI [0.14, 0.78]), and not significantly correlated with a more severe lack of spontaneity and flow of conversation, although the effect size was moderate (r_s=.40, p=.068, 95% CI [-0.03, 0.70]). In contrast, in the BPD+AVH group, hallucinatory behaviour was not significantly correlated with delusions (r_s=.16, p=.512, 95% CI [-0.31, 0.56]), conceptual disorganization (r_s=.-18, p=.438,

95% CI [-0.58, 0.29]), passive/apathetic social withdrawal (r_s=-.20, *p*=.389, 95% CI [-0.59, 0.27]), lack of spontaneity and flow of conversation (r_s=-.40, *p*=.081, 95% CI [-0.72, 0.05]), or stereotyped thinking (r_s=-.19, *p*=.418, 95% CI [-0.58, 0.28]). The effect sizes were small except for lack of spontaneity and flow of conversation, where the effect size was moderate.

Dissociative symptoms in youth with BPD+AVH compared to youth with SZ+AVH and association between hallucinations and dissociation in these groups (research question 4)

Differences in dissociation between the BPD+AVH group (M(SD)=83.26 (57.53), Mdn=63.00, MR=25.00) and the SZ+AVH group (M(SD)=56.03 (43.76), Mdn=39.78, MR=18.55) were not significant, *U*=161.00, *p*=.093, θ=0.35, 95% CI [0.21, 0.52]. In the group including BPD+AVH and SZ+AVH participants, the DSS was not significantly correlated with the PSYRATS-AH items (*p*>.05), except for a moderate correlation with increased loudness, r_s=.30, *p*=.047, 95% CI [0.01, 0.55]. In addition, the DSS was not significantly correlated with the hallucinatory behaviour item of the PANSS (*p*>.05). When the correlation analyses were repeated in the two groups separately and compared between the groups, significant group differences were found for the correlations between the DSS and beliefs about the origin of the voices (*p*=.047) and disruption to life caused by voices (*p*=.026) of the PSYRATS-AH. In the BPD+AVH group, the DSS was moderately correlated with a stronger conviction that the voices were solely due to external causes (r_s=.41, p=.051, 95% CI [-0.00, 0.70), and with voices causing more severe disruption to life (r_s=.40, p=.056, 95% CI [-0.01, 0.70]). In contrast, in the SZ+AVH group, the DSS was weakly correlated with a stronger belief that the voices could also be internally generated (r_s=-.24, p=.318, 95% CI [-0.61, 0.23]), and with voices causing less severe disruption to life (r_s=-.32, p=.174, 95% CI [-0.67, 0.15]). Notably, none of these correlations reached statistical significance and the

effect sizes were small. The two groups did not differ significantly in the correlations between the DSS and the PANSS hallucinatory behaviour item (p>.05).

Extent of psychopathology in youth with BPD+AVH compared to youth with BPD no AVH (research question 5)

The comparison of psychopathology between the BPD+AVH group and the BPD no AVH group is summarized in Table 4. The BPD+AVH showed significantly higher scores on the parasuicidal behaviour and the dissociation and paranoid ideation subscales of the BPDSI than the BPD no AVH group. When analysing the items assessing for self-harm and suicidal thoughts, plans, and attempts separately, significantly higher scores for self-harm were found in the BPD+AVH group, while no group differences occurred for suicidal thoughts, plans, and attempts. When analysing the items assessing for dissociation and paranoid ideation separately, significantly higher scores for dissociation and paranoid ideation were found in the BPD+AVH group. In addition, the BPD+AVH group had significantly higher scores for dissociation (as measured by the DSS), anxiety, and stress (both assessed with the DASS-21) than the BPD no AVH group. As shown in Table 4, the effect sizes for these group differences were moderate to large. No significant group differences were found in depressive symptoms, co-occurring psychiatric disorders, and psychosocial functioning.

Discussion

This is the first study to explore the phenomenology of AVH and presence of other psychotic symptoms in youth with BPD. The main findings to emerge from this study are that AVH (as assessed by the PSYRATS-AH) in youth with BPD are phenomenologically indistinguishable from those in SZ and associated with high levels of general psychopathology. This indicates that AVH in youth with BPD should be taken seriously.

The current study found no differences in AVH between youth with BPD and youth with SZ when measured using the PSYRATS-AH items. This suggests that AVH experienced by youth with BPD are similar to the AVH occurring in SZ with regard to physical (frequency, duration, location, loudness), cognitive (beliefs regarding origin of voices, disruption to life, controllability), and emotional (negative content, distress) characteristics. This finding is largely consistent with studies of adult patient samples (Kingdon et al., 2010; Pearse et al., 2014; Slotema et al., 2012; Tschoeke et al., 2014).

In addition, youth with BPD+AVH had less severe delusions and less difficulty with abstract thinking, and more hostility than youth with SZ+AVH, as assessed by the PANSS positive and negative symptom items. These results are partly consistent with Tschoeke et al.'s (2014) study that reported less severe delusions, conceptual disorganization and negative symptoms in adults with BPD compared with patients with SZ. The higher hostility scores in youth with BPD are consistent with inappropriate and intense anger being a core feature of this disorder (Leichsenring, Leibing, Kruse, New, & Leweke, 2011), as well as with evidence indicating that, in young people, BPD is a risk factor for perpetrating violence (Arola et al., 2016; González, Igoumenou, Kallis, & Coid, 2016).

When the relationship between hallucinations and other psychotic symptoms was examined using PANSS items, youth with either BPD or SZ with more severe hallucinations also had

more severe delusions, but this correlation was only statistically significant for the SZ group. A lack of statistical power might have contributed to the non-significant correlation between hallucinations and delusions for the BPD group in the current study, as Niemantsverdriet et al. (2017) found a positive correlation between hallucinations and delusions in a sample of 98 adults with BPD. In the current study, youth with SZ who had more severe hallucinations also had greater conceptual disorganization and more negative symptoms (i.e., passive/apathetic social withdrawal, stereotyped thinking). In contrast, no significant association was found between hallucinations and negative or disorganized symptoms in youth with BPD, which is consistent with the non-significant findings reported in a study of adults with BPD (Niemantsverdriet et al., 2017).

The current study found no significant group difference in dissociation between youth with BPD+AVH and SZ+AVH, which stands in contrasts to studies reporting more dissociative symptoms in adults with BPD compared with SZ (Lyssenko et al., 2018; Tschoeke et al., 2014). Also, there was no significant association between the severity of dissociation and the severity of hallucinations (i.e., auditory, visual, gustatory, olfactory, tactile) in either youth with BPD+AVH or SZ+AVH, which is consistent with the results reported by Tschoeke et al. (2014) for adults with BPD or SZ. In addition to this, the current study found that patients with BPD or SZ who experienced more dissociation reported louder AVH. Interestingly, a positive correlation was found in the BPD+AVH group between dissociative symptoms and the PSYRATS-AH items assessing for beliefs about the origin of voices and disruption to life caused by voices. These correlations were of medium size, but did not reach statistical significance, probably due to a lack of statistical power in the current study. Nevertheless, these findings might indicate that dissociative symptoms in youth with BPD are not associated with severity (i.e., frequency, intensity) of AVH, as in psychotic disorders (Pilton et al., 2015), but with a higher likelihood that these voices are perceived as louder, and

interpreted as coming from an external source, or causing more severe disruption to the person's life.

Youth with BPD+AVH showed significantly higher levels of psychopathology, including self-harm, paranoid ideation, dissociation, anxiety, and stress, compared with youth with BPD who did not experience AVH. These results extend previous findings from studies of adults with BPD reporting that AVH were associated with a greater number of suicide plans and attempts (Slotema et al., 2017), a higher number of hospital admissions (Slotema et al., 2017), a greater number of BPD criteria (Slotema et al., 2017), and more comorbid mental state diagnoses (Niemantsverdriet et al., 2017; Slotema et al., 2017). The current study of youth with BPD did not replicate the finding from adult samples of more co-occurring psychiatric diagnoses associated with AVH among individuals with BPD. A possible explanation for this might be that common co-occurring mental disorders among individuals with BPD emerge later in the course of the disorder, with BPD increasing the risk for the development of subsequent mental state disorders (Biskin, 2015). The mean age of the BPD groups included in this study ranged between 18 and 20 years, yet the median age of onset for mood disorder is reported to be 25-45 years, for anxiety disorder 25-53 years, and for substance abuse disorders 18-29 years (Kessler et al., 2007). Nevertheless, these results add to the evidence indicating that patients with BPD and AVH belong to a subgroup with a more severe form of BPD (Niemantsverdriet et al., 2017). This interpretation is also compatible with a recently proposed model for the development of personality pathology during adolescence (Sharp & Wall, 2017). Sharp and Wall (2017) argued that borderline pathology represents what is common to all personality pathology, namely impaired function in self-other relatedness (DSM-5 Section III Criterion A), and lies on the severity pathway between internalizing/externalizing and psychotic psychopathology (severity or 'p' factor). Adolescence is a sensitive period for identity formation and thus, the time when in

individuals with personality pathology the progression from internalizing/externalizing to the next level of maladaptive self-other function occurs, which brings with it increases in psychotic psychopathology or psychiatric severity (‘p’).

The current study has several limitations. First, the sample size was small. Small samples lack the power to conclusively decide whether a non-significant finding might actually reflect the absence of an effect altogether or whether the effect was relevant but too small to be detected (Button et al., 2013). This applies to both non-significant group differences and correlations in the current study. To address this issue, the current study reported effect sizes and confidence intervals for all group comparisons and associations of variables of interest. Second, the current study did not adjust for multiple comparisons and accepted an increased risk of Type I errors (i.e., false positive findings), as this study was exploratory, looking at patterns of results. Future studies should be conducted to confirm the findings of this study. Third, youth who met the diagnostic criteria for both BPD and SZ were excluded from the current study. The few studies that have examined adults with both BPD and SZ reported high rates of childhood trauma (Hepworth et al., 2013; Kingdon et al., 2010), emotional resistance against the voices (Hepworth et al., 2013), and poor outcome (Slotema, Blom, Niemantsverdriet, Deen, & Sommer, 2018) in this group. These results highlight the need to investigate this particularly vulnerable group in future studies in more detail. Fourth, participants in the BPD+AVH group were significantly more often female and younger than participants in the SZ+AVH group. As non-parametric tests were used, gender and age could not be adjusted for in the analyses. The gender difference between the groups reflects typical presentation rates in clinical settings, as BPD is more frequently diagnosed in female patients (Silberschmidt, Lee, Zanarini, & Schulz, 2015), while psychotic disorders are more frequently diagnosed in male patients (Amminger et al., 2006). Similar gender differences have been found in adult samples (Hepworth et al., 2013; Kingdon et al., 2010). The younger

age in the BPD+AVH participants could be due to the fact that personality disorder usually emerges earlier (Chanen et al., 2017; Chanen & Thompson, 2014) than psychotic disorders (Kessler et al., 2007). In line with this, Slotema et al. (2012) reported that the mean age of AVH onset was 16 years in adults with BPD, compared with 20 years in adults with SZ. Fifth, the PANSS has been criticized for not measuring all constructs currently considered as relevant for the negative symptom dimension (i.e., blunted affect, alogia, anhedonia, asociality and avolition) appropriately (Marder and Galderisi, 2017). Finally, this is a cross-sectional study. Both BPD and first-episode psychosis diagnoses are known to be unstable and it is possible that diagnostic group membership might change over time.

The current findings have several clinical implications. First, as AVH in youth with BPD seem to be similar to those in youth with SZ, the use of labels such as "pseudo-" or "quasi-hallucinations" to differentiate AVH in people with BPD from AVH in people with SZ are not justified (Hepworth et al., 2013; Kingdon et al., 2010; Niemantsverdriet et al., 2017; Pearse et al., 2014; Slotema et al., 2012; Tschoeke et al., 2014) and simply add to the stigma and discrimination already experienced by people with BPD. The finding of phenomenologically similar AVH in youth with BPD or SZ also adds to the evidence that DSM-5 criterion 9 or the ICD-10 description of BPD are inadequate accounts of the experience of psychotic symptoms in BPD. Therefore, this criterion might require revision. A clear implication for clinicians working with youth with BPD is that they should enquire whether their patients experience AVH. If the answer is yes, clinicians should take the AVH as seriously as they would if a patient with a DSM-5 psychotic disorder discloses hearing voices. Second, the current findings that youth with BPD showed less severe delusions and negative symptoms than youth with SZ, and that AVH in BPD might co-occur with delusions, but not with disorganized (e.g., formal thought disorder) or negative symptoms, together with similar findings in studies of adults with BPD (Niemantsverdriet et al., 2017;

Tschoeke et al., 2014), could help to improve differential diagnosis between BPD and SZ. For example, an individual with BPD who reports hearing voices should be diagnosed with BPD only, if the AVH are not accompanied by other psychotic symptoms, or with a co-occurring DSM-5 diagnosis of schizophrenia spectrum disorder (or any other type of psychotic disorder), if the AVH are accompanied by at least one more symptom listed under the A-criterion (i.e., delusions, disorganized or catatonic behaviour or negative symptoms) (Waters, Blom, Jardri, Hugdahl, & Sommer, 2017). Third, the finding that youth with BPD who had AVH showed higher levels of psychopathology than youth with BPD who did not have AVH indicates that clinicians should keep in mind that AVH in youth with BPD might be a marker of a more severe form of BPD that might require the careful assessment and treatment of co-occurring psychopathology.

To conclude, the current study replicated in a youth sample the findings that AVH in BPD are phenomenologically indistinguishable from those with SZ, when assessed by the PSYRATS-AH, and are associated with high levels of general psychopathology. When youth with BPD report AVH, clinicians should take these symptoms seriously and should consider that these young people might belong to a subgroup with a particularly severe form of BPD. It is unknown whether these symptoms respond to conventional treatments for AVH and such clinical trials are urgently required.

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Table 1. Participants' demographics

	BPD no AVH (n=23)	BPD+AVH (n=23)	SZ+AVH (n=22)	Group differences	
	M (SD) / n (%)	M (SD) / n (%)	M(SD) / n (%)	Test statistic	*p*
Gender				χ^2=20.39	.000***
Male	1 (4.3)	1 (4.3)	12 (54.5)		
Female	22 (95.7)	22 (95.7)	10 (45.5)		
Age (years)	20.13 (2.49)	18.13 (2.30)	20.05 (3.09)	*F*(2, 65)=4.18	.020*
Romantic relationship	9 (39.1)	8 (34.8)	4 (18.2)	χ^2=2.59	.311
In education	9 (39.1)	17 (73.9)	8 (36.4)	χ^2(2)=7.98	.018*
Employed	11 (50.0)	8 (34.8)	7 (31.8)	χ^2(2)=1.77	.413
Financial support				χ^2=1.94	.762
Employment	8 (34.8)	4 (17.4)	5 (22.7)		
Acquaintances	8 (34.8)	10 (43.5)	9 (40.9)		
Government benefits	7 (30.4)	9 (39.1)	8 (36.4)		
Socioeconomic Status				χ^2=4.74	.310
Low	7 (30.4)	10 (43.5)	6 (27.3)		
Middle	6 (26.1)	9 (39.1)	10 (45.5)		
High	10 (43.5)	4 (17.4)	6 (27.3)		

Notes. BPD, borderline personality disorder; SZ, first episode psychosis; AVH, auditory verbal hallucinations; M(SD), mean(standard deviation). Significant at: *, $p < .05$; **, $p < .01$; ***, $p < .001$.

Table 2. Comparison of the Psychotic Symptom Rating Scales – Auditory Hallucinations items between the BPD+AVH group and the SZ+AVH group

	BPD+AVH (n=23)			SZ+AVH (n=22)			Group differences		
	M (SD)	Mnd	MR	M (SD)	Mnd	MR	*U*	*p*	ES (θ) and (95%) CI
Frequency	2.35 (1.15)	2.00	22.13	2.50 (1.10)	2.50	23.91	273.00	.639	0.54 (0.38, 0.69)
Duration	2.78 (1.09)	2.00	21.02	3.14 (1.04)	3.50	25.07	298.50	.270	0.59 (0.42, 0.74)
Perceived location	2.35 (0.98)	2.00	20.43	2.77 (1.11)	3.00	25.68	312.00	.165	0.62 (0.45, 0.76)
Loudness	2.43 (0.95)	2.00	24.02	2.27 (0.99)	2.00	21.93	229.50	.572	0.45 (0.30, 0.62)
Beliefs about origin	1.96 (0.93)	2.00	22.52	2.09 (1.15)	2.00	23.50	264.00	.792	0.52 (0.36, 0.68)
Amount of negative content	3.26 (0.96)	4.00	25.13	2.82 (1.30)	3.00	20.77	204.00	.234	0.40 (0.26, 0.57)
Degree of negative content	3.70 (0.64)	4.00	26.50	3.14 (1.17)	3.00	19.34	172.50	.034*	0.34 (0.21, 0.51)
Amount of distress	2.70 (1.26)	3.00	22.30	2.82 (1.30)	3.00	23.73	269.00	.705	0.53 (0.37, 0.69)
Intensity of distress	2.96 (1.07)	3.00	25.15	2.59 (1.14)	3.00	20.75	203.50	.236	0.40 (0.26, 0.57)
Disruption of life	1.61 (0.78)	2.00	23.50	1.50 (0.86)	2.00	22.48	241.50	.779	0.48 (0.32, 0.64)
Controllability	3.39 (1.27)	4.00	23.78	3.45 (0.91)	4.00	22.18	235.00	.616	0.46 (0.31, 0.63)

Notes. AVH, auditory verbal hallucinations; BPD, borderline personality disorder; CI, confidence interval; ES, effect size; M(SD), mean(standard deviation); Mnd, median; MR, mean rank; SZ, schizophrenia spectrum disorder. Significant at: *, $p < .05$.

Table 3. Comparison of the items assessing positive and negative symptoms of the Positive And Negative Syndrome Scale (PANSS) between the BPD+AVH group and the SZ+AVH group

	BPD+AVH (n=20)			SZ+AVH (n=22)			Group differences		
	M (SD)	Mdn	MR	M (SD)	Mdn	MR	*U*	*p*	ES (θ) and (95%) CI
Delusions	3.35 (0.88)	3.00	17.30	4.00 (1.31)	4.00	25.32	304.00	.024*	0.69 (0.51, 0.82)
Conceptual disorganization	1.65 (0.75)	1.50	20.98	2.05 (1.43)	1.00	21.98	230.50	.771	0.52 (0.36, 0.69)
Hallucinatory behavior	4.60 (0.60)	5.00	22.20	4.18 (1.47)	5.00	20.86	206.00	.702	0.47 (0.31, 0.64)
Excitement	2.05 (1.00)	2.00	24.82	1.55 (1.06)	1.00	18.48	153.50	.057	0.35 (0.21, 0.53)
Grandiosity	1.45 (0.83)	1.00	22.08	1.41 (0.96)	1.00	20.98	208.50	.686	0.47 (0.31, 0.64)
Suspiciousness	3.50 (1.15)	4.00	20.28	3.55 (1.57)	4.00	22.61	244.50	.521	0.56 (0.38, 0.71)
Hostility	2.25 (1.25)	2.00	26.40	1.32 (0.94)	1.00	17.05	122.00	.004**	0.28 (0.16, 0.45)
Blunted affect	1.60 (1.14)	1.00	18.18	2.55 (1.82)	2.00	24.52	286.50	.063	0.65 (0.47, 0.79)
Emotional withdrawal	1.85 (1.23)	1.00	20.25	2.14 (1.28)	1.50	22.64	245.00	.488	0.56 (0.39, 0.71)
Poor rapport	1.55 (0.83)	1.00	18.78	2.09 (1.15)	2.00	23.98	274.50	.135	0.62 (0.45, 0.77)
Passive-apathetic social withdrawal	2.85 (1.39)	3.00	24.18	2.27 (1.42)	2.00	19.07	166.50	.164	0.38 (0.23, 0.55)
Difficulty in abstract thinking	1.85 (1.18)	1.00	17.00	2.95 (1.50)	3.00	25.59	310.00	.017*	0.70 (0.53, 0.83)
Lack of spontaneity and flow of conversation	1.70 (0.98)	1.00	19.80	2.32 (1.76)	1.00	23.05	254.00	.323	0.58 (0.40, 0.73)
Stereotyped thinking	1.30 (0.73)	1.00	22.15	1.23 (0.87)	1.00	20.91	207.00	.560	0.47 (0.31, 0.64)

Notes. AVH, auditory verbal hallucinations; BPD, borderline personality disorder; CI, confidence interval; ES, effect size; M(SD), mean(standard deviation; Mdn, median; MR, mean rank SZ, schizophrenia spectrum disorder. Significant at: *, $p < .05$; **, $p < .01$.

Table 4. Comparison of psychopathology between the BPD+AVH group and the BPD no AVH group

	BPD+AVH				BPD no AVH				Group differences		
	n	M (SD)	Mdn	MR	n	M (SD)	Mdn	MR	Test statistic	*p*	ES and (95%) CI
BPDSI Abandonment	23	3.62 (2.70)	4.00	25.55	23	2.86 (2.27)	3.14	20.57	*U*=197.00	.202	θ=0.37 (0.23, 0.54)
BPDSI Interpersonal Relationships	23	3.56 (2.08)	3.56	23.93	23	3.22 (1.96)	3.13	22.11	*U*=232.50	.641	θ=0.44 (0.29, 0.60)
BPDSI Identity	23	1.65 (1.00)	1.88	25.91	23	1.32 (0.89)	1.38	20.22	*U*=189.00	.145	θ=0.36 (0.22, 0.53)
BPDSI Impulsivity	23	2.01 (1.68)	1.50	21.50	23	2.30 (1.61)	1.91	24.43	*U*=286.00	.453	θ=0.54 (0.38, 0.69)
BPDSI Parasuicidal Behaviour	23	3.30 (2.25)	3.27	28.77	23	1.50 (1.26)	1.15	17.48	*U*=126.00	.004**	θ=0.24 (0.13, 0.40)
BPDSI Self-Harm items	23	3.25 (2.66)	3.50	29.57	23	0.92 (1.06)	0.75	16.72	*U*=108.50	.001**	θ=0.21 (0.11, 0.37)
BPDSI Suicidality items	23	3.39 (2.25)	3.10	26.07	23	2.41 (2.09)	1.80	20.07	*U*=185.50	.125	θ=0.35 (0.22, 0.52)
BPDSI Affective Instability	23	8.13 (1.42)	8.30	26.48	23	7.01 (2.37)	7.00	19.67	*U*=176.50	.082	θ=0.33 (0.20, 0.50)
BPDSI Emptiness	23	5.56 (3.05)	6.50	22.48	23	5.74 (2.73)	6.25	23.50	*U*=264.50	.794	θ=0.50 (0.34, 0.66)
BPDSI Outbursts of Anger	23	3.58 (2.02)	3.58	26.70	23	2.59 (1.84)	2.17	19.46	*U*=171.50	.064	θ=0.32 (0.20, 0.49)
BPDSI Dissociation and Paranoid Ideation	23	4.98 (2.46)	4.63	29.39	23	2.45 (2.30)	2.13	16.89	*U*=112.50	.001**	θ=0.21 (0.11, 0.37)
BPDSI Dissociation items	23	4.19 (2.73)	3.94	27.23	23	2.45 (2.56)	1.80	18.96	*U*=160.00	.034*	θ=0.30 (0.18, 0.47)
BPDSI Paranoid Ideation items	23	6.29 (2.71)	6.67	30.61	23	2.43 (3.05)	1.33	15.72	*U*=85.50	.000***	θ=0.16 (0.08, 0.32)
DSS	23	83.26 (57.53)	63	29.48	23	36.04 (28.81)	29.00	17.52	*U*=127.00	.003**	θ=0.24 (0.13, 0.41)
DASS-21 Depression	23	15.26 (4.97)	16.00	27.17	23	11.83 (6.16)	11.00	19.83	*U*=180.00	.062	θ=0.34 (0.21, 0.51)
DASS-21 Anxiety	23	13.74 (4.84)	13.00	28.57	23	9.52 (4.49)	10.00	18.43	*U*=148.00	.010*	θ=0.28 (0.16, 0.45)
DASS-21 Stress	23	15.04 (3.95)	16.00	27.74	23	11.89 (5.00)	12.00	19.26	*U*=167.00	.032**	θ=0.32 (0.19, 0.48)
No of co-occurring mental state diagnoses	21	3.67 (1.88)	4.00	21.00	23	3.30 (2.03)	3.00	21.35	*U*=215.00	.527	θ=0.45 (0.29, 0.61)
No of co-occurring PD diagnoses	21	1.14 (1.20)	1.00	24.19	23	0.78 (0.85)	1.00	20.96	*U*=206.00	.376	θ=0.43 (0.28, 0.60)
SOFAS	23	52.74 (12.16)	N/A	N/A	23	58.78 (11.87)	N/A	N/A	*t*(44)=-1.71	.095	*d*=.50 (-0.08, -1.09)

Notes. AVH, auditory verbal hallucinations; BPD, borderline personality disorder; BPDSI, Borderline Personality Disorder Index; DASS-21, Depression Anxiety Stress Scale; DSS, Dissociation Tension Scale; M(SD), mean(standard deviation; Mdn, median; MR, mean rank; N/A = not applicable; SOFAS, Social and Occupational Functioning Assessment Scale. Significant at: *, $p < .05$; **, $p < .01$; ***, $p < .001$.